Pin for connecting gears to a supporting member, and transmission featuring such a pin

Patent number: EP1028275
Publication date: 2000-08-16
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Classification:
- international: F16H57/08; F16H1/28; F16C27/02
- european: F16C27/02; F16H1/28B3; F16H57/08B
Application number: EP20000102862 20000211
Priority number(s): IT1999TO00109 19990212

Also published as:
US6409414 (B1)
JP2000274515 (A)
EP1028275 (A3)
CA2298144 (A1)
EP1028275 (B1)

Cited documents:
DE19706686
EP0003894
US3943787

Abstract of **EP1028275**

A pin (14) for connecting a gear (5) to a supporting member (6) has a first (19) and a second (20) longitudinal end portion connectable to the supporting member (6); a first intermediate portion (21) extending from the first end portion (19); and a second intermediate portion (22) extending from the second end portion (20), and which differs in size from the first intermediate portion (21) and has a flexural strength differing from that of the first intermediate portion (21).

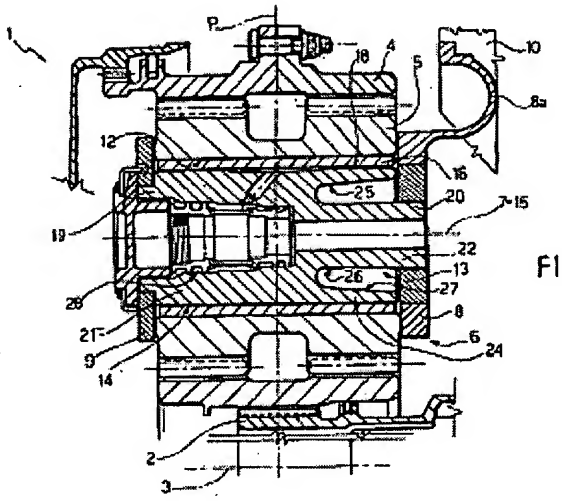

FIG. 2

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 028 275 A3

EUROPEAN PATENT APPLICATION

(12)

(51) Int. Cl.[7]: F16H 57/08, F16H 1/28, F16C 27/02

(88) Date of publication A3:
17.01.2001 Bulletin 2001/03

(43) Date of publication A2:
16.08.2000 Bulletin 2000/33

(21) Application number: 00102862.0

(22) Date of filing: 11.02.2000

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 12.02.1999 IT TO990109

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(54) Pin for connecting gears to a supporting member, and transmission featuring such a pin

(57) A pin (14) for connecting a gear (5) to a supporting member (6) has a first (19) and a second (20) longitudinal end portion connectable to the supporting member (6); a first intermediate portion (21) extending from the first end portion (19); and a second intermediate portion (22) extending from the second end portion (20), and which differs in size from the first intermediate portion (21) and has a flexural strength differing from that of the first intermediate portion (21).

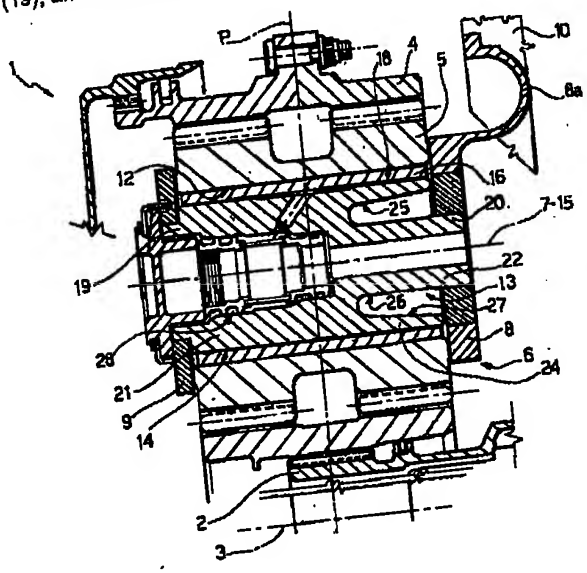


FIG. 2

EP 1 028 275 A3

Description

[0001] The present invention relates to a pin for connecting gears to a supporting member.

[0002] More specifically, the present invention relates to a supporting pin which may be used to advantage, though not exclusively, in epicyclic gear trains for transmitting severe loads in general, and in epicyclic gear trains of aircraft transmissions in particular, to which the following description refers purely by way of example.

[0003] Aircraft transmissions normally comprise an epicyclic gear train in turn comprising a sun gear, a ring gear, and a number of planet wheels interposed between the sun and ring gears and supported on a planet carrier.

[0004] In most applications, the planet carrier comprises two substantially platelike elements positioned facing each other on opposite axial sides of the planet wheels, and connected integrally to each other by a number of angularly equally spaced cross members or tenons normally integral with both the platelike elements. Each of the planet wheels is connected to the carrier by a respective supporting pin, the opposite ends of which are each connected to a respective platelike element, and to which the respective planet wheel is in turn normally connected via the interposition of a bearing, normally a friction bearing.

[0005] During operation of the gear train, the carrier is stressed by forces which, in some cases, result in deformation of the carrier and, in particular, in displacement of the two platelike elements with respect to each other.

[0006] Displacement of the platelike elements in turn results in deformation of both the tenons and the supporting pins, the axes of which pass from an ideal work or rest condition parallel to the axes of the sun and ring gears, to a real or critical work condition in which they form, with the sun and ring gear axes, an angle of other than zero and which varies according to the intensity of the forces transmitted.

[0007] Deflection of the pin axes and, hence, of the respective planet wheel axes with respect to the ring and sun gear axes results in uneven distribution of the contact pressures between the planet wheel teeth and those of both the sun and ring gear, which in turn results, not only in general malfunctioning of the gear train, but also in rapid wear of the contacting parts of the gear train in relative motion.

[0008] To eliminate the above drawbacks, dedicated supporting pins are used, which have opposite elastic end portions of the same size, which deform elastically alongside deformation of the platelike elements and respective tenons to ensure the gears mesh correctly at all times. Also, between the carrier and the supporting body, provision is and must be made for a load balancing assembly, which comprises a number of axial arms connected integrally to the supporting body; and, for each arm, a respective connecting member lying in a plane perpendicular to the sun and ring gear axes and through the center lines of the planet wheels.

[0009] Known balancing assemblies of the above type are particularly complex, are extremely expensive to both produce and maintain, and, being highly stressed, are subject to frequent breakdowns and malfunctioning.

[0010] It is an object of the present invention to provide a supporting pin designed to solve the aforementioned problems in a straightforward, low-cost manner.

[0011] According to the present invention, there is provided a pin for connecting a gear to a supporting member; the pin having a respective axis, and comprising a first and a second longitudinal end portion connectable to said supporting member; a first intermediate portion extending from said first end portion; and a second intermediate portion extending from said second end portion; characterized in that said first and said second intermediate portion differ from each other in size and in flexural strength.

[0012] A non-limiting embodiment of the invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows schematically, and with parts removed for clarity, an epicyclic transmission featuring a number of supporting pins in accordance with the present invention;

Figure 2 shows a larger-scale section along line II-II in Figure 1;

Figure 3 shows a section of a detail in Figure 2.

[0013] Number 1 in Figures 1 and 2 indicates as a whole an epicyclic transmission for an aircraft (not shown). Transmission 1 comprises a sun gear 2 rotating about a respective axis 3; a rotating ring gear 4 coaxial with axis 3; and a number of planet wheels 5 - in the example shown, five - meshing with ring gear 4 and sun gear 2, and connected to a planet carrier 6 so as to rotate about respective axes 7 parallel to one another and to axis 3.

[0014] Carrier 6 extends coaxially with axis 3, is formed in one piece from metal material, and comprises two facing platelike bodies 8 and 9 (Figure 2). In the particular example shown, body 8 is connected integrally in known manner - e.g. by means of a bracket 8a and screws or pins not shown - to a fixed body 10 (shown schematically) supporting carrier 6. Carrier 6 also comprises a number of known tenons (not shown) extending axially between, and integral with, platelike bodies 8 and 9. In a variation not shown, body 8 is connected integrally to an output shaft, and ring gear 4 is connected integrally to a fixed body.

[0015] Each planet wheel 5 has a central axial through hole 12, and is connected to platelike bodies 8 and 9 of carrier 6 by a respective supporting device 13. As shown in Figure 2, device 13 extends through hole

12, and comprises a supporting pin 14 having a respective axis 15; and a bushing 16 made of antifriction material and interposed between pin 14 and the relative planet wheel.

[0016] Pin 14 is asymmetrical with respect to a plane P (Figures 2 and 3) perpendicular to axis 15 and through the center line of pin 14, and is defined laterally by a cylindrical supporting surface 18 coaxial with axis 15 and having a straight generating line. Pin 14 comprises two opposite tubular longitudinal end portions 19 and 20, which, in the particular example shown, engage, with substantially no clearance, respective axial through holes formed in bodies 8 and 9. Alternatively, in a variation not shown, portion 19 engages the respective hole and is therefore connected integrally to body 9, while portion 20 simply rests against a support carried by body 8, so that pin 14 acts in the same way as an ordinary rod restrained at one end and resting against a support at the opposite end.

[0017] As shown in Figures 2 and 3, pin 14 also comprises two tubular cylindrical intermediate portions 21 and 22 extending from portions 19 and 20 respectively, and having respective outside diameters and different respective cross sections measured in respective planes parallel to plane P. More specifically, portion 21 has an outside diameter and a cross section greater than those of portion 22, and a much greater flexural strength than portion 22, or at least such that, when pin 14 is stressed in use, portion 22 is the only one to undergo substantial elastic deformation.

[0018] As shown in Figures 2 and 3, pin 14 also comprises a further tubular portion 24, which is defined externally by surface 18, projects from intermediate portion 21, and surrounds intermediate portion 22. Tubular portion 24 is defined internally by a conical surface 25, which extends facing an outer lateral surface 26 of intermediate portion 22 and has an inside diameter tapering towards end portion 19. Surface 25 is spaced apart from lateral surface 26, and defines, together with surface 26, a cavity 27 in which portion 22 flexes in use.

[0019] As shown in Figure 2, pin 14 houses a known lubricating device 28, not described in detail, for supplying lubricating fluid between pin 14 and bushing 16.

[0020] Each pin 14 acts in the same way as an ordinary variable-section rod restrained at at least one end, and the different intermediate resisting sections of pin 14 are so sized that, when the loads transmitted by planet wheels 5 to carrier 6 are such as to deform platelike bodies 8 and 9 and the tenons (not shown) of carrier 6, portion 22 flexes as shown by the dash line in Figure 3, while both portions 21 and 24 remain substantially undeformed. In fact, by virtue of the particular connection of end portions 19 and 20 to platelike bodies 8 and 9, and of the deformation of platelike bodies 8 and 9 themselves, the deflection of portion 22 generates a reaction on body 9 in opposition to the forces acting on relative planet wheel 5, to enable surface 18 of pin 14 to move while remaining parallel to itself and, hence, planet wheel 5 to mesh correctly at all times with both sun gear 2 and ring gear 4. Maintaining a substantially unchanged mesh condition between the planet wheels and the sun and ring gears alongside variations in the deformation of carrier 6 prevents the generation of undesired, unpredictable forces between the meshing teeth and local deformation of bushings 16, which would obviously result in steady, rapid impairment not only of the epicyclic gear train but also of the transmission as a whole.

[0021] As compared with known solutions, the particular geometry of pins 14 also provides for greatly reducing both the manufacturing and running cost of transmission 1. That is, the geometry of pins 14, and in particular the fact that each comprises only one reaction portion which is elastically deformable when stressed, enables only one of the two platelike bodies - in the example shown, body 8 - to be connected directly to the carrier 6 supporting body, with no need, as in known solutions, for complex, high-cost load balancing devices.

[0022] Clearly, changes may be made to pins 14 as described herein without, however, departing from the scope of the present invention. In particular, the various portions of pins 14 may be formed differently from those described by way of example, or may be replaced by respective portions performing equivalent functions.

Claims

1. A pin (14) for connecting a gear (5) to a supporting member (6); the pin (14) having a respective axis (15), and comprising a first (19) and a second (20) longitudinal end portion connectable to said supporting member (6); a first intermediate portion (21) extending from said first end portion (19); and a second intermediate portion (22) extending from said second end portion (20); characterized in that said first (21) and said second (22) intermediate portion differ from each other in size and in flexural strength.

2. A pin as claimed in Claim 1, characterized in that said first intermediate portion (21) has a cross section, measured in a plane perpendicular to said axis (15), greater than a cross section of said second intermediate portion (22) measured in a further plane parallel to said plane.

3. A pin as claimed in Claim 1 or 2, characterized by being asymmetrical with respect to a plane (P) perpendicular to said axis (15) and through the center line of said pin (14).

4. A pin as claimed in Claim 2 or 3, characterized by being defined laterally by a cylindrical supporting surface (18), and by also comprising a single tubu-

lar portion (24) projecting, coaxially with said axis (15), from said first intermediate portion (21), and surrounding said second intermediate portion (22); said single tubular portion (24) being defined externally by said cylindrical surface (18).

5. A pin as claimed in Claim 4, characterized in that said single tubular portion (24) is defined internally by a surface (25) facing an outer lateral surface (26) of said second intermediate portion (22) and spaced apart from said outer lateral surface (26); said second intermediate portion (22) being deformed, in use, inside said single tubular portion (24).

6. A mechanical transmission (1) comprising a supporting member (6) extending along a respective axis (3) and in turn comprising a first (8) and a second (9) substantially platelike portion facing and connected to each other; at least one gear (5) interposed between said first (8) and said second (9) portion; and a pin (14) connecting said gear (5) to said first (8) and said second (9) portion; the pin (14) having a respective axis (15), and comprising a first longitudinal end portion (19) joined to said second platelike portion (9); a second longitudinal end portion (20) connected to said supporting member (6); a cylindrical first intermediate portion (21) extending from said first end portion (19); and a cylindrical second intermediate portion (22) extending from said second end portion (20); characterized in that said first (21) and said second (22) intermediate portion differ from each other in size and in flexural strength.

7. A transmission as claimed in Claim 6, characterized by also comprising connecting means (8a) for connecting said supporting member (6) directly to a connecting body (10); said connecting means (8a) being interposed between one (8) of said platelike portions (8)(9) and said connecting body (10).

8. A transmission as claimed in Claim 7, characterized in that one (8) of said platelike portions (8)(9) is connected integrally to said connecting body (10).

FIG. 1

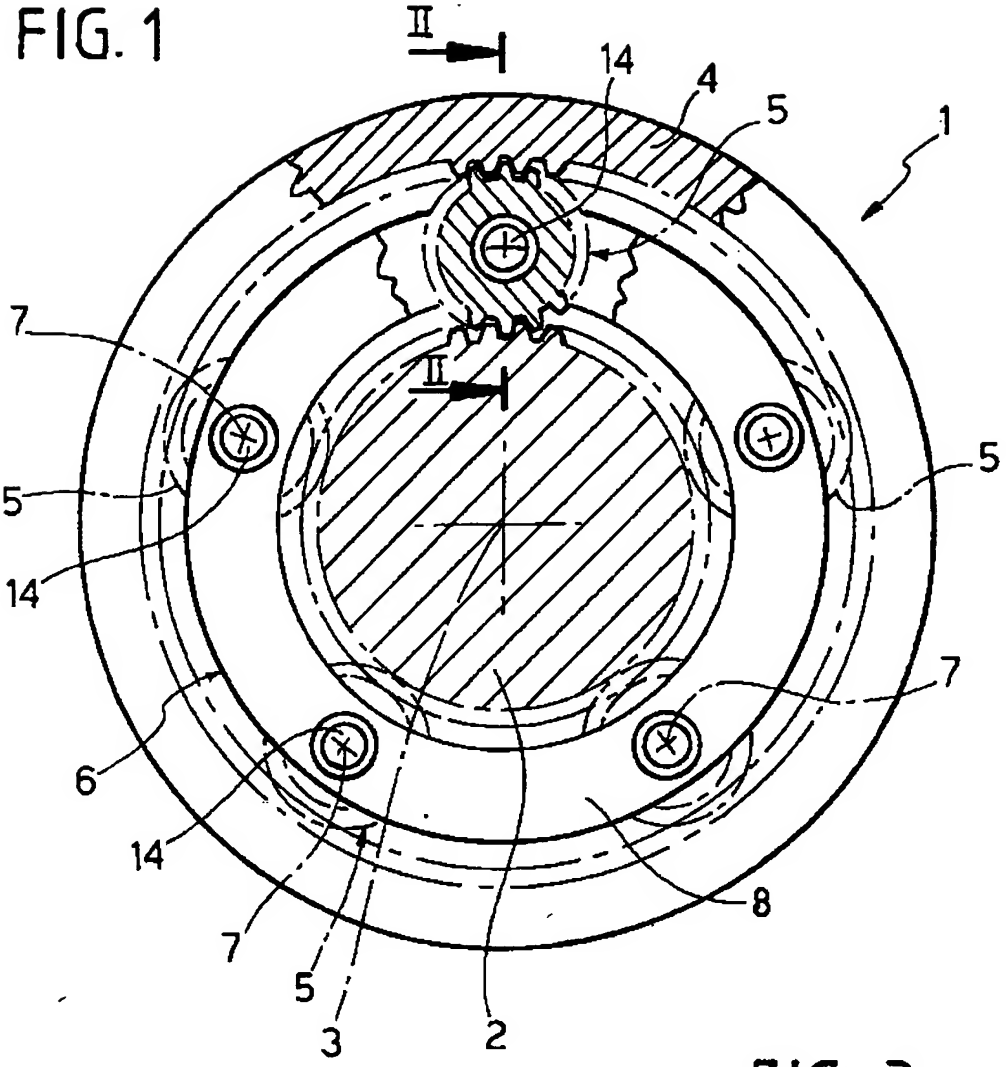


FIG. 3

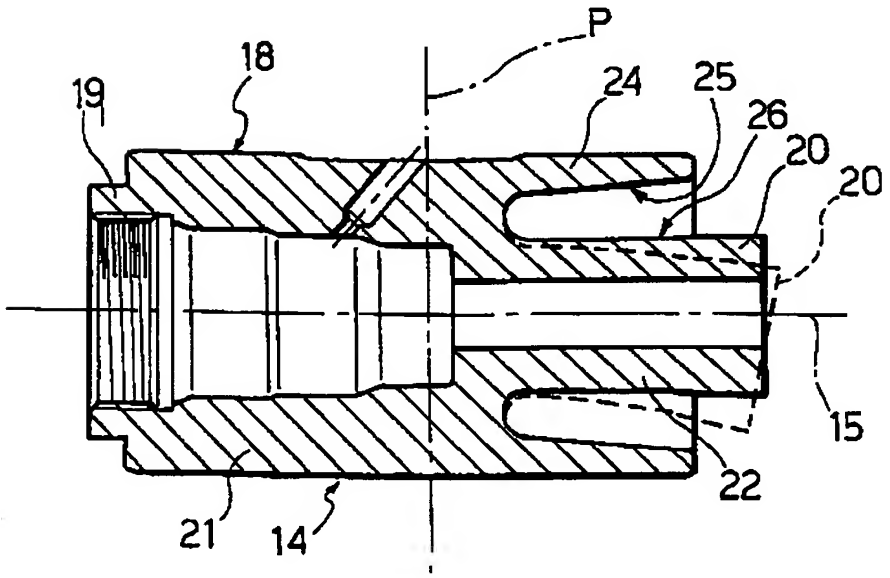
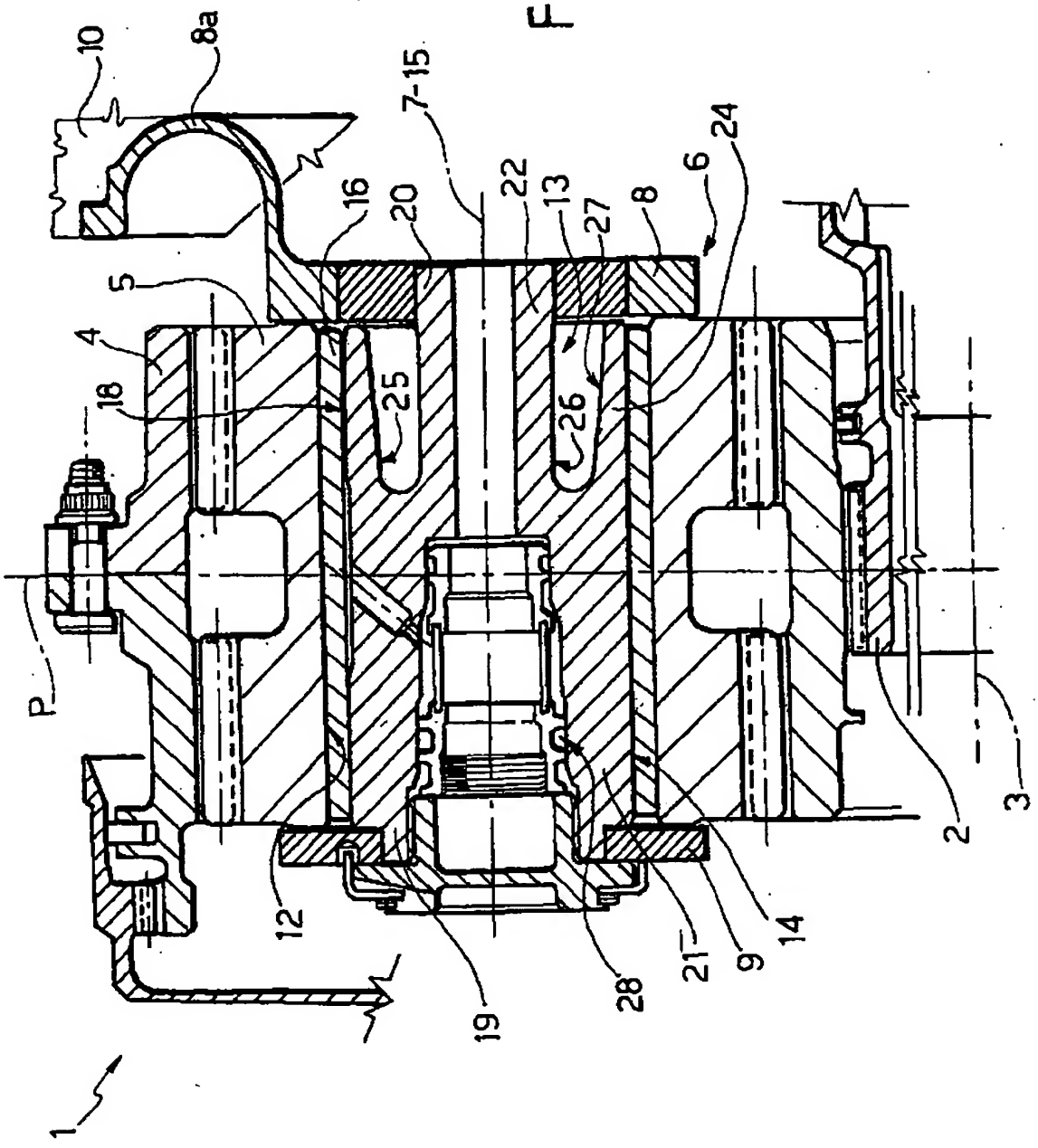


FIG.2



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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 2862

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X A	DE 197 06 686 A (TAUSEND ERICH) 27 August 1998 (1998-08-27) * column 1, line 3 - column 2, line 21 * * column 2, line 60 - line 64; figures *	1-3,6-8 4,5	F16H57/08 F16H1/28 F16C27/02
A	EP 0 003 894 A (HICKS TRANSMISSIONS LTD R J) 5 September 1979 (1979-09-05) * page 1, line 1 - page 5, line 24; figures *	1,6	
A	US 3 943 787 A (HICKS RAYMOND JOHN) 16 March 1976 (1976-03-16) * column 1, line 4 - column 2, line 19; figures *	1,6	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F16H
F16C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 November 2000	Daehnhardt, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 10 2862

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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29-11-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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EP 0003894 A	05-09-1979	DE 2961847 D	04-03-1982
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		CA 1002786 A	04-01-1977
		DE 2517225 A	06-11-1975
		FR 2268202 A	14-11-1975
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Description

[0001] The present invention relates to a pin for connecting gears to a supporting member.

[0002] More specifically, the present invention relates to a supporting pin which may be used to advantage, though not exclusively, in epicyclic gear trains for transmitting severe loads in general, and in epicyclic gear trains of aircraft transmissions in particular, to which the following description refers purely by way of example.

[0003] Aircraft transmissions normally comprise an epicyclic gear train in turn comprising a sun gear, a ring gear, and a number of planet wheels interposed between the sun and ring gears and supported on a planet carrier.

[0004] In most applications, the planet carrier comprises two substantially platelike elements positioned facing each other on opposite axial sides of the planet wheels, and connected integrally to each other by a number of angularly equally spaced cross members or tenons normally integral with both the platelike elements. Each of the planet wheels is connected to the carrier by a respective supporting pin, the opposite ends of which are each connected to a respective platelike element, and to which the respective planet wheel is in turn normally connected via the interposition of a bearing, normally a friction bearing.

[0005] During operation of the gear train, the carrier is stressed by forces which, in some cases, result in deformation of the carrier and, in particular, in displacement of the two platelike elements with respect to each other.

[0006] Displacement of the platelike elements in turn results in deformation of both the tenons and the supporting pins, the axes of which pass from an ideal work or rest condition parallel to the axes of the sun and ring gears, to a real or critical work condition in which they form, with the sun and ring gear axes, an angle of other than zero and which varies according to the intensity of the forces transmitted.

[0007] Deflection of the pin axes and, hence, of the respective planet wheel axes with respect to the ring and sun gear axes results in uneven distribution of the contact pressures between the planet wheel teeth and those of both the sun and ring gear, which in turn results, not only in general malfunctioning of the gear train, but also in rapid wear of the contacting parts of the gear train in relative motion.

[0008] To eliminate the above drawbacks, a different dedicated supporting pins are used as disclosed in DE 197 06 686 A1, EP-A- 0 003 894 and US-A-3 943 787. In particular, DE 197 06 686 A1 according to which the preamble of claim 1 is established, discloses a pin inserted in one side of a planetary carrier as a cylindrical fit. An inner ring is interposed between a roller bearing supporting the planetary wheel and the pin and is radially supported by a short cylindrical section at the centre of load. Also, between the carrier and the supporting body, provision is and must be made for a load balancing assembly, which comprises a number of axial arms connected integrally to the supporting body; and, for each arm, a respective connecting member lying in a plane perpendicular to the sun and ring gear axes and through the center lines of the planet wheels.

[0009] Known balancing assemblies of the above type are particularly complex, are extremely expensive to both produce and maintain, and, being highly stressed, are subject to frequent breakdowns and malfunctioning.

[0010] It is an object of the present invention to provide a supporting pin designed to solve the aforementioned problems in a straightforward, low-cost manner.

[0011] According to the present invention, there is provided a pin for connecting a gear to a supporting member as claimed in claim 1

[0012] A non-limiting embodiment of the invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows schematically, and with parts removed for clarity, an epicyclic transmission featuring a number of supporting pins in accordance with the present invention;
Figure 2 shows a larger-scale section along line II-II in Figure 1;
Figure 3 shows a section of a detail in Figure 2.

[0013] Number 1 in Figures 1 and 2 indicates as a whole an epicyclic transmission for an aircraft (not shown). Transmission 1 comprises a sun gear 2 rotating about a respective axis 3; a rotating ring gear 4 coaxial with axis 3; and a number of planet wheels 5 - in the example shown, five - meshing with ring gear 4 and sun gear 2, and connected to a planet carrier 6 so as to rotate about respective axes 7 parallel to one another and to axis 3.

[0014] Carrier 6 extends coaxially with axis 3, is formed in one piece from metal material, and comprises two facing platelike bodies 8 and 9 (Figure 2). In the particular example shown, body 8 is connected integrally in known manner - e.g. by means of a bracket 8a and screws or pins not shown - to a fixed body 10 (shown schematically) supporting carrier 6. Carrier 6 also comprises a number of known tenons (not shown) extending axially between, and integral with, platelike bodies 8 and 9. In a variation not shown, body 8 is connected integrally to an output shaft, and ring gear 4 is connected integrally to a fixed body.

[0015] Each planet wheel 5 has a central axial through hole 12, and is connected to platelike bodies 8 and 9 of carrier 6 by a respective supporting device 13. As shown in Figure 2, device 13 extends through hole 12, and comprises a supporting pin 14 having a respective axis 15; and a bushing 16 made of antifriction material and interposed between pin 14 and the relative planet wheel.

[0016] Pin 14 is asymmetrical with respect to a plane

P (Figures 2 and 3) perpendicular to axis 15 and through the center line of pin 14, and is defined laterally by a cylindrical supporting surface 18 coaxial with axis 15 and having a straight generating line. Pin 14 comprises two opposite tubular longitudinal end portions 19 and 20, which, in the particular example shown, engage, with substantially no clearance, respective axial through holes formed in bodies 8 and 9. Alternatively, in a variation not shown, portion 19 engages the respective hole and is therefore connected integrally to body 9, while portion 20 simply rests against a support carried by body 8, so that pin 14 acts in the same way as an ordinary rod restrained at one end and resting against a support at the opposite end.

[0017] As shown in Figures 2 and 3, pin 14 also comprises two tubular cylindrical intermediate portions 21 and 22 extending from portions 19 and 20 respectively, and having respective outside diameters and different respective cross sections measured in respective planes parallel to plane P. More specifically, portion 21 has an outside diameter and a cross section greater than those of portion 22, and a much greater flexural strength than portion 22, or at least such that, when pin 14 is stressed in use, portion 22 is the only one to undergo substantial elastic deformation.

[0018] As shown in Figures 2 and 3, pin 14 also comprises a further tubular portion 24, which is defined externally by surface 18, projects from intermediate portion 21, and surrounds intermediate portion 22. Tubular portion 24 is defined internally by a conical surface 25, which extends facing an outer lateral surface 26 of intermediate portion 22 and has an inside diameter tapering towards end portion 19. Surface 25 is spaced apart from lateral surface 26, and defines, together with surface 26, a cavity 27 in which portion 22 flexes in use.

[0019] As shown in Figure 2, pin 14 houses a known lubricating device 28, not described in detail, for supplying lubricating fluid between pin 14 and bushing 16.

[0020] Each pin 14 acts in the same way as an ordinary variable-section rod restrained at at least one end, and the different intermediate resisting sections of pin 14 are so sized that, when the loads transmitted by planet wheels 5 to carrier 6 are such as to deform platelike bodies 8 and 9 and the tenons (not shown) of carrier 6, portion 22 flexes as shown by the dash line in Figure 3, while both portions 21 and 24 remain substantially undeformed. In fact, by virtue of the particular connection of end portions 19 and 20 to platelike bodies 8 and 9, and of the deformation of platelike bodies 8 and 9 themselves, the deflection of portion 22 generates a reaction on body 9 in opposition to the forces acting on relative planet wheel 5, to enable surface 18 of pin 14 to move while remaining parallel to itself and, hence, planet wheel 5 to mesh correctly at all times with both sun gear 2 and ring gear 4. Maintaining a substantially unchanged mesh condition between the planet wheels and the sun and ring gears alongside variations in the deformation of carrier 6 prevents the generation of undesired, unpredictable forces between the meshing teeth and local deformation of bushings 16, which would obviously result in steady, rapid impairment not only of the epicyclic gear train but also of the transmission as a whole.

[0021] As compared with known solutions, the particular geometry of pins 14 also provides for greatly reducing both the manufacturing and running cost of transmission 1. That is, the geometry of pins 14, and in particular the fact that each comprises only one reaction portion which is elastically deformable when stressed, enables only one of the two platelike bodies - in the example shown, body 8 - to be connected directly to the carrier 6 supporting body, with no need, as in known solutions, for complex, high-cost load balancing devices.

[0022] Clearly, changes may be made to pins 14 as described herein. In particular, the various portions of pins 14 may be formed differently from those described or may be replaced by respective portions performing equivalent functions, without, however, departing from the scope of the present invention as defined by the appended claims.

Claims

1. A pin (14) for connecting a gear (5) to a supporting member (6); the pin (14) having a respective axis (15), and comprising a first (19) and a second (20) longitudinal end portion connectable to said supporting member (6); a first intermediate portion (21) extending from said first end portion (19); and a second intermediate portion (22) extending from said second end portion (20); said first (21) and said second (22) intermediate portion differ from each other in size and in flexural strength. said first intermediate portion (21) having a cross section, measured in a plane perpendicular to said axis (15), greater than a cross section of said second intermediate portion (22) measured in a further plane parallel to said plane; the pin (14) being asymmetrical with respect to a plane (P) perpendicular to said axis (15) and through the center line of said pin (14), and being **characterized by** being defined laterally by a cylindrical supporting surface (18), and by also comprising a single tubular portion (24) projecting, coaxially with said axis (15), from said first intermediate portion (21), and surrounding said second intermediate portion (22); said single tubular portion (24) being defined externally by said cylindrical surface (18).

2. A pin as claimed in Claim 1, **characterized in that** said single tubular portion (24) is defined internally by a surface (25) facing an outer lateral surface (26) of said second intermediate portion (22) and spaced apart from said outer lateral surface (26); said second intermediate portion (22) being deformed, in use, inside said single tubular portion

(24).

3. A mechanical transmission (1) comprising a supporting member (6) extending along a respective axis (3) and in turn comprising a first (8) and a second (9) substantially platelike portion facing and connected to each other; at least one gear (5) interposed between said first (8) and said second (9) portion; and a pin (14) connecting said gear (5) to said first (8) and said second (9) portion; **characterized in that** said pin is defined as claimed in Claim 1.

4. A transmission as claimed in Claim 3, **characterized by** also comprising connecting means (8a) for connecting said supporting member (6) directly to a connecting body (10); said connecting means (8a) being interposed between one (8) of said platelike portions (8)(9) and said connecting body (10).

5. A transmission as claimed in Claim 4, **characterized in that** one (8) of said platelike portions (8)(9) is connected integrally to said connecting body (10).

Patentansprüche

1. Bolzen (14) zur Verbindung eines Getrieberads (5) mit einem Tragelement (6); wobei der Bolzen (14) eine jeweilige Achse (15) aufweist und einen ersten (19) und einen zweiten (20) Längsendabschnitt umfaßt, der mit dem Tragelement (6) verbunden werden kann; einen ersten Zwischenabschnitt (21), der von diesem ersten Endabschnitt (19) aus verläuft; und einen zweiten Zwischenabschnitt (22), der von diesem zweiten Endabschnitt (20) aus verläuft; wobei dieser erste (21) und dieser zweite (22) Zwischenabschnitt sich in der Größe und in der Biegefestigkeit voneinander unterscheiden;
wobei der erste Zwischenabschnitt (21) einen Querschnitt aufweist, gemessen in einer Ebene, die rechtwinklig zur Achse (15) ist, der größer ist als ein Querschnitt des zweiten Zwischenabschnitts (22), gemessen in einer weiteren Ebene, die parallel zu dieser Ebene ist;
wobei der Bolzen (14) asymmetrisch in bezug auf eine Ebene (P) ist, die rechtwinklig zur Achse (15) ist und durch die Mittellinie des Bolzens (14) führt; und
dadurch gekennzeichnet, daß er seitlich durch eine zylindrische Auflagefläche (18) definiert wird, und daß er auch einen einzelnen rohrförmigen Abschnitt (24) umfaßt, der mit der Achse (15) koaxial ist, vom ersten Zwischenabschnitt (21) hervorragt und den zweiten Zwischenabschnitt (22) umgibt; wobei dieser einzelne rohrförmige Abschnitt (24) außen durch die zylindrische Fläche (18) definiert wird.

2. Bolzen nach Anspruch 1, **dadurch gekennzeichnet, daß** der einzelne rohrförmige Abschnitt (24) innen durch eine Fläche (25) definiert wird, die einer äußeren Seitenfläche (26) des zweiten Zwischenabschnitts (22) gegenüberliegt und von dieser äußeren Seitenfläche (26) beabstandet ist; wobei der zweite Zwischenabschnitt (22) in Gebrauch im Inneren des einzelnen rohrförmigen Abschnitts (24) verformt wird.

3. Mechanisches Getriebe (1), umfassend ein Tragelement (6), das entlang einer jeweiligen Achse (3) verläuft und seinerseits einen ersten (8) und einen zweiten (9), im wesentlichen plattenartigen Abschnitt aufweist, die einander gegenüberliegen und miteinander verbunden sind; mindestens ein Getrieberad (5), das zwischen dem ersten (8) und dem zweiten (9) Abschnitt angeordnet ist; und einen Bolzen (14), der dieses Getrieberad (5) mit dem ersten (8) und dem zweiten (9) Abschnitt verbindet; **dadurch gekennzeichnet, daß** dieser Bolzen wie in Anspruch 1 beansprucht definiert ist.

4. Getriebe nach Anspruch 3, **dadurch gekennzeichnet, daß** es auch Verbindungsmittel (8a) umfaßt, um das Tragelement (6) direkt mit einem Verbindungskörper (10) zu verbinden; wobei diese Verbindungsmittel (8a) zwischen einem (8) der plattenartigen Abschnitte (8)(9) und dem Verbindungskörper (10) angeordnet sind.

5. Getriebe nach Anspruch 4, **dadurch gekennzeichnet, daß** einer (8) der plattenartigen Abschnitte (8) (9) mit dem Verbindungskörper (10) fest verbunden ist.

Revendications

1. Tourillon (14) pour coupler un engrenage (5) à un élément porteur (6) ; le tourillon (14) ayant un axe respectif (15) et comprenant une première (19) et une seconde (20) partie d'extrémité longitudinale pouvant être couplées audit élément porteur (6) ; une première partie intermédiaire (21) s'étendant depuis ladite première partie d'extrémité (19) et une seconde partie intermédiaire (22) s'étendant depuis ladite seconde partie d'extrémité (20) ; ladite première (21) et ladite seconde (22) partie intermédiaire diffèrent l'une de l'autre en taille et en résistance à la flexion,
ladite première partie intermédiaire (21) ayant une section transversale, mesurée dans un plan perpendiculaire audit axe (15), plus grande qu'une section transversale de ladite seconde partie intermédiaire (22) mesurée dans un autre plan parallèle audit plan ; le tourillon (14) étant asymétrique par rapport à un plan (P) perpendiculaire audit axe (15)

et à travers la ligne centrale dudit tourillon (14) et étant **caractérisé par** le fait d'être défini latéralement par une surface porteuse cylindrique (18) et également de comprendre une unique partie tubulaire (24) faisant saillie, coaxialement avec ledit axe (15), depuis ladite première partie intermédiaire (21) et entourant ladite seconde partie intermédiaire (22) ; ladite unique partie tubulaire (24) étant définie à l'extérieur par ladite surface cylindrique (18).

2. Tourillon comme revendiqué dans la revendication 1, **caractérisé en ce que** ladite unique partie tubulaire (24) est définie à l'intérieur par une surface (25) faisant face à une surface latérale externe (26) de ladite seconde partie intermédiaire (22) et espacée de ladite surface latérale externe (26) ; ladite seconde partie intermédiaire (22) étant définie, en utilisation, à l'intérieur de ladite unique partie tubulaire (24).

3. Transmission mécanique (1) comprenant un élément porteur (6) s'étendant le long d'un axe respectif (3) et, à son tour, comprenant une première (8) et une seconde (9) partie substantiellement semblable à une plaque faisant face et couplée l'une à l'autre ; au moins un engrenage (5) interposé entre ladite première (8) et ladite seconde (9) partie ; et un tourillon (14) couplant ledit engrenage (5) à ladite première (8) et à ladite seconde (9) partie ; **caractérisé en ce que** ledit tourillon est défini comme revendiqué dans la revendication 1.

4. Transmission comme revendiqué dans la revendication 3, caractérisée également par le fait de comprendre un moyen de couplage (8a) pour coupler ledit élément porteur (6) directement au corps de couplage (10) ; ledit moyen de couplage (8a) étant interposé entre l'une (8) desdites parties semblables à une plaque (8) (9) et ledit corps de couplage (10).

5. Transmission comme revendiqué dans la revendication 4, **caractérisée en ce que** l'une (8) desdites parties semblables à une plaque (8) (9) est couplée intégralement audit corps de couplage (10).

FIG. 1

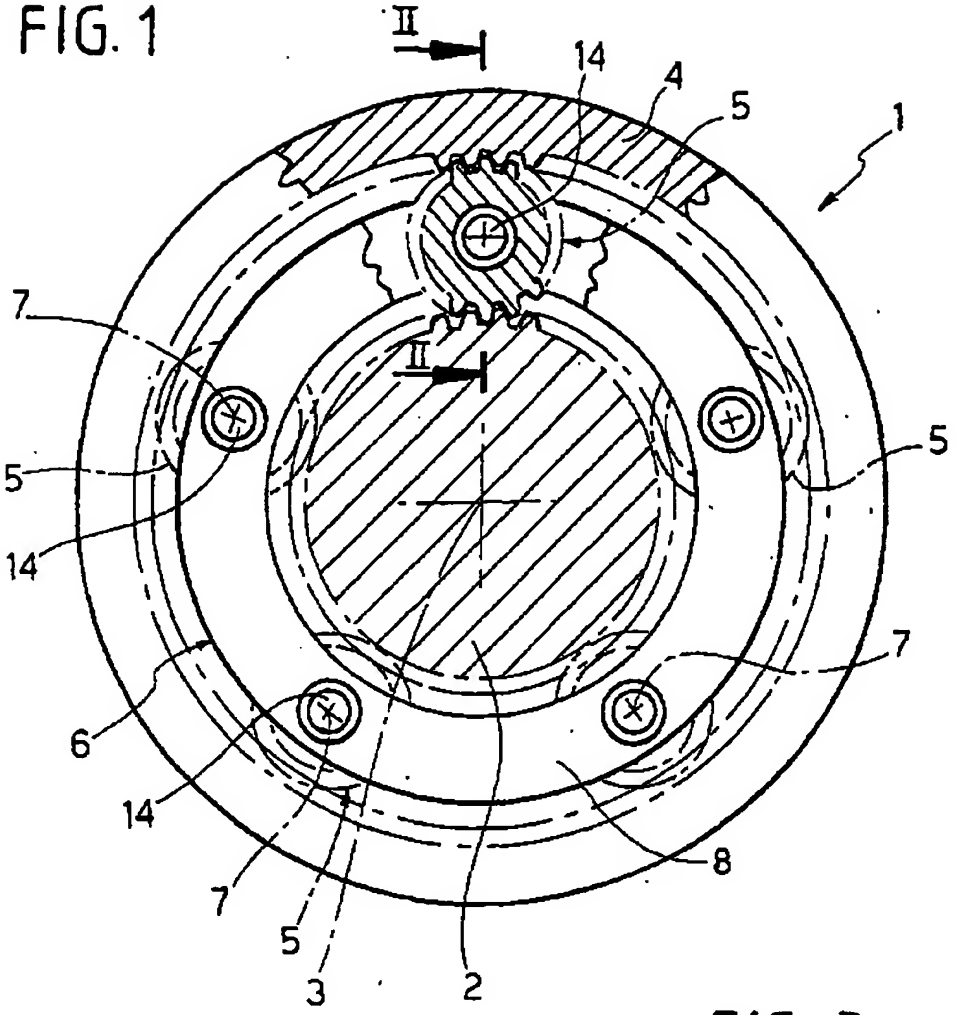

FIG. 3

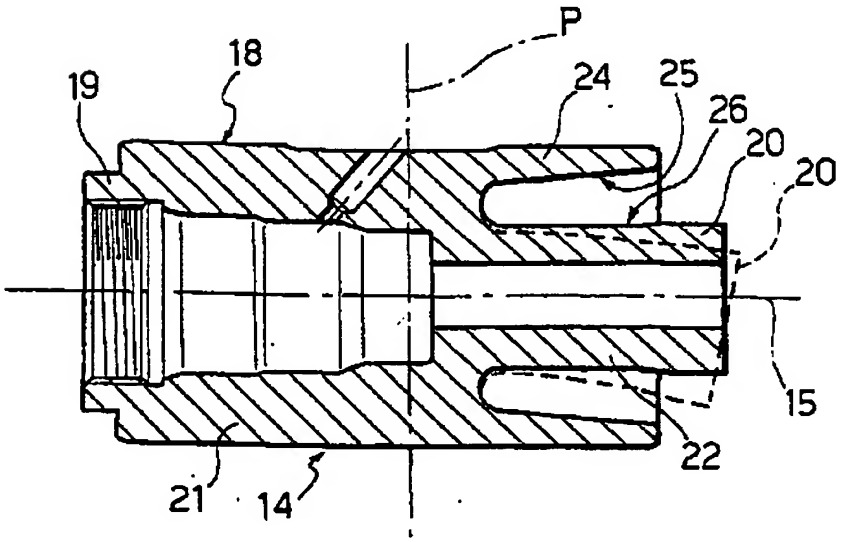

FIG. 2